Lower Passaic River Interim Remedy Feasibility Study
Proposed Model Metrics for the Revised IR FS Report
December 16, 2019

Summarized below are CPG's proposed model metrics to be included in the next draft of the IR FS report and a modified approach to characterizing model uncertainty. Changes from the first draft of the report are intended to yield a more comprehensive comparative evaluation (i.e., relative versus absolute differences/similarities) of IR remedial benefit across the alternatives and take into consideration EPA's comments on the August 2019 draft IR FS report.

Proposed Model Metrics to be Included in the Revised Draft of the IR FS Report

The following metrics are proposed for the revised FS report:

- Surface sediment COPC SWAC for RM 0-8.3, RM 8.3-15, and RM 0-15 (post-remedy period only)
- Water column COPC concentration for RM 8.3-15
- Water column net COPC flux at RM 0, RM 8.3, and RM 15
- Gross COPC erosion flux from RM 8.3-15 sediments (post-remedy period only)
- COPC concentration on depositing fine sediment in RM 8.3-15 (post-remedy period only)
- Surface sediment COPC SWAC recovery rate for RM 8.3-15 over the post-remedy period, expressed as a half-life

The first three metrics were included in the August 2019 draft IR FS report (SWAC on Figures 8-5, 8-7, and 8-8; water column concentration on Figures 8-9 and 8-15; water column net flux on Figures 8-12 ,8-14, 8-17, and 8-19). The runs and approach used to define the uncertainty band for each alternative (discussed below) and the way the information is presented are subject to change as the report is being revised. For example, in Figures 8-7 and 8-8 the initial SWAC (dashed red line) will be updated to match the reach being plotted and results from more recent uncertainty runs will be incorporated.

The predicted gross erosion flux from RM 8.3 to 15 sediments over the 10-year post-remedy period (the fourth metric in the above list) will be added to characterize the effectiveness of source control achieved by the IR alternatives, given that erosion is the principle mechanism for contaminants from internal sources to enter the water column and redistribute to other areas. An example of this metric is shown in the top panel of Figure 3 of the CPG statement to the CSTAG/NRRB[1] (included here as Attachment 1), but in the FS report uncertainty bands will be included for consistency with the model usage guidelines (or "guardrails") that were developed jointly by CPG, EPA, and NJDEP[2].

The concentration on depositing fine sediment particles in RM 8.3 to 15 (the fifth metric in the above list) will be added as another metric of source control, given that these concentrations will control the recovery of the sediment bed in the IR area over the long-term. It is proposed that this metric be calculated as the ratio of the total contaminant deposition flux over the 10-year post remedy period to the total deposition flux of cohesive sediment. This approach is favored over taking the time average of

[1] CPG, 2019. Cooperating Parties Group NRRB/CSTAG Statement. Upper 9 Mile Interim Remedy and Adaptive Management. November 12, 2019.
[2] CPG, 2019. Regarding the Use and Limitations of Model Projections in Evaluating and Comparing Remedial Alternatives in the IR FS. Submitted to USEPA and approved on March 21, 2019.

the ratio of the fluxes because it is a better estimate of the average concentrations that the sediment bed "sees". An example of this metric is shown in the bottom panel of Figure 3 of the CSTAG/NRRB document (included here as Attachment 1), but in the FS report uncertainty bands will be included for consistency with the March 21, 2019 model usage and limitations guidelines. It is further proposed that, for brevity, this metric be used in lieu of the sorbed concentrations in the water column, which were requested in EPA FS Comment 225.

The RM 8.3 to 15 surface sediment recovery rate over the post-remedy period (the sixth metric in list above), expressed as a half-life, is proposed as a direct quantification of long-term recovery in the IR region. It is proposed that this metric be presented in lieu of the year-by-year mass recovery rate presented in Figure 8-6 of the August 2019 draft FS report because the long-term recovery is more relevant to assessing IR effectiveness at controlling sources. Consistent with EPA FS comment number 268, the proposed recovery rate will be expressed as a half-life. CPG is currently evaluating two approaches to calculating the rate: (1) by assuming a first order decay between the predicted concentration at the end of year 8 (when all IR alternatives are complete) and the predicted concentration 10 years later (end of year 18); and (2) by extrapolating a log-linear regression of concentrations at the end of each year of the post-remedy period (assumed to be the approach used in generating the figure accompanying EPA FS Comment 268). Consistent with other metrics, SWAC recovery rates would be calculated for each simulation and then expressed as ranges for each alternative.

CPG also proposes to omit the year-to-year recovery rate presented for the mean water column concentrations (Figure 8-10) from the revised FS. The focus of the recovery evaluation should be the long-term, and judging the SWAC recovery over the full post-remedy period (discussed above) will provide a relevant perspective that is not confounded by year-to-year variability in the hydrograph. A draft of revised model projection metrics (updating Table 8-2 of the August 2019 draft IR FS report) is included as Attachment 2.

Proposed Approach to Characterizing Model Uncertainty

In the August draft FS report, model results for the base COPC mapping (CS 37) were presented as ranges considering the model uncertainty associated with the representation of the IR alternatives in the sediment transport (ST) model. This approach was applied for consistency with the model usage guidelines. The uncertainty band around each alternative was calculated from two bounding CFT runs:

- Simulations using MNR-ST, i.e., runs that did not simulate the release of solids due to dredging or the change in bed properties due to capping in the upper 9 miles of the LPR (these effects were represented in the lower 8 mile ROD remedy using a 3% release rate[3])
- Simulations using remedy-ST, which included a 3% solids release and capping of cells for which more than half of the cell area was remediated.

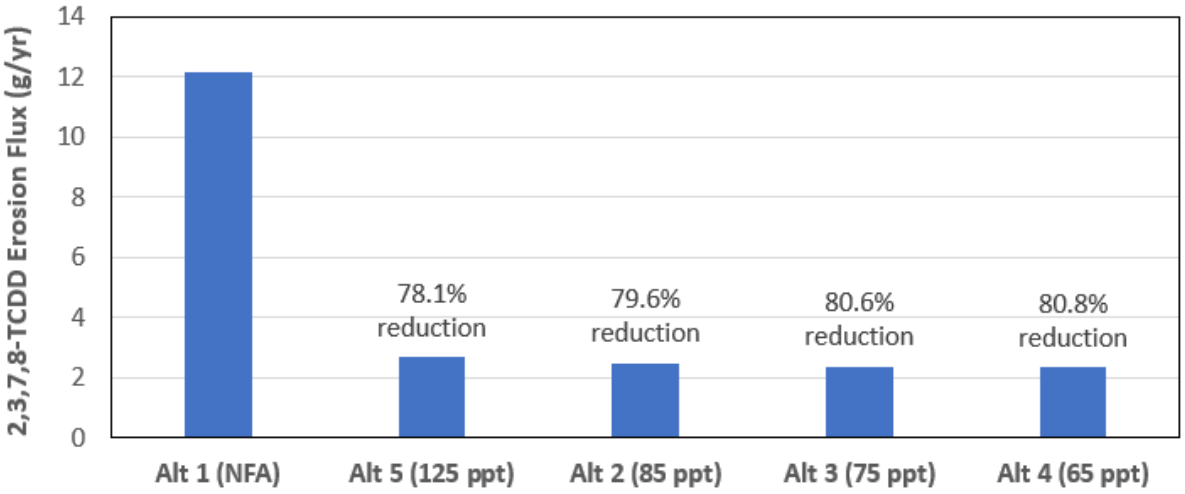
While the MNR-ST scenario was run for all alternatives, the remedy-ST scenario was run only for the 75 ppt alternative (Alternative 3).[4] The uncertainty bands for the 125 ppt, 85 ppt, and 65 ppt alternatives

[3] The remediation is always represented in the lower 8-miles because this region is not subject to the complications that arise in the upper river due to sub-grid scale remedial targets.
[4] CPG, 2019. Lower Passaic River Interim Remedy Feasibility Study. Summary of Projection Modeling Approach. Submitted to USEPA on February 28, 2019.

(Alternatives 5, 2, and 4, respectively) were derived by applying the relative difference between the two representations of the 75 ppt alternative to the MNR-ST results for the other alternatives.

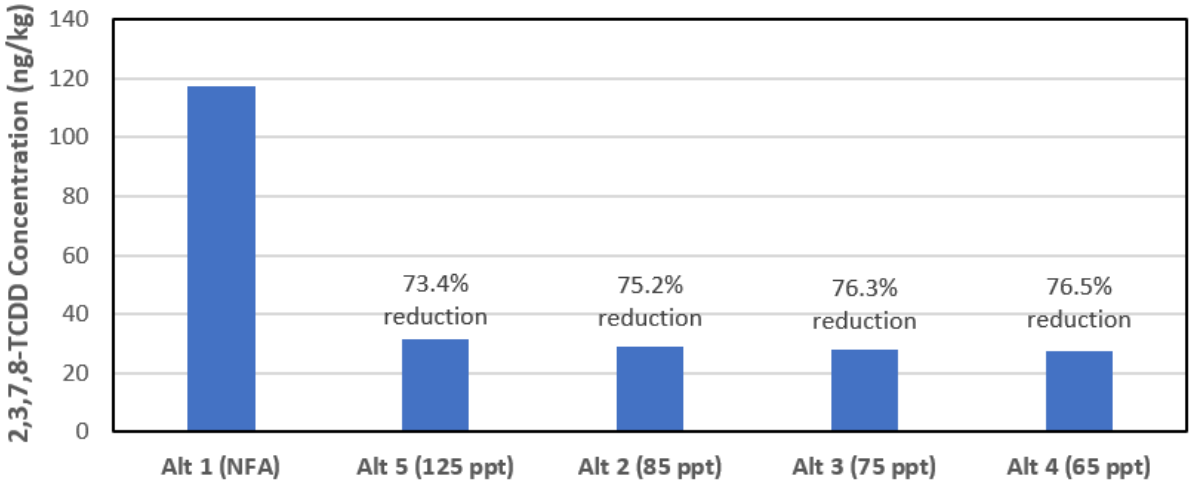
For the revised FS report, two changes will be made in the characterization of uncertainty. First, the uncertainty of the release rate of solids and associated contaminant to the water column during dredging will also be considered. Simulations with a 1% dredge release rate will be used along with the 3% runs to define the uncertainty band for each metric. For example, the upper and lower bounds of the uncertainty band for the surface sediment SWAC metric will now reflect the difference between the simulation using MNR-ST with a dredge release rate of 3% and the simulation using remedy-ST with a dredge release rate of 1%, respectively. Note the simulations that acts as bounds for the uncertainty band may vary by metric. Second, remedy-ST simulations of the other alternatives will be added (for both the 3% and 1% release rates) so that the uncertainty band for each alternative no longer needs to be derived from simulations of Alternative 3.

a)



Note: Based on total flux over the 10-year post-remedy period in the base FS model projections.

b)



Note: The concentration on depositing fine (cohesive) particles was computed as the ratio of the total chemical deposition flux to the total fine sediment deposition flux over the 10-year post remedy period.

Filepath: \\boston1\Jobs\Passaic_CPG\DOCUMENTS\2019\CSTAG_NRRB_meeting\figures\native\Figure 3_ErosionAndDepo.docx

Figure 3
Post-Remedy 2,3,7,8-TCDD Erosion Flux from RM 8.3 to RM 15 Sediments and Average 2,3,7,8-TCDD Concentration on Depositing Fine Sediments in RM 8.3 to 15
Cooperating Parties Group NRRB/CSTAG Statement
Lower Passaic River Study Area

Attachment 2. Revisions to Draft IR FS Table 8-2: Model Projection Metrics to Support IR FS Evaluation Metrics

Model Result	Metric to Compare Alternatives	Method of Comparing Ranges of Results among Alternatives	Cross Reference to Table 8-1
Average Surface Sediment COPC Concentration (SWAC) for RM 0–RM 8.3 and for RM 8.3–RM 15	Rates of recovery (expressed as half-life) over the 10-year post-remedy period	Rates of recovery compared among active IR alternatives and MNR, and relative changes in rates for active IR alternatives compared to rate for MNR	1
	End of year averages to the end of the projection period	End of year averages compared among active IR alternatives and MNR, and relative changes in end of year averages for active IR alternatives compared to MNR	2
Average Water Column COPC Concentration for RM 8.3–RM 15	Average concentration during the IR implementation period	Averages compared among active IR alternatives and MNR, and relative changes in averages for active IR alternatives compared to MNR	4
	Average concentration during the 10-year post remedy period	Averages compared among active IR alternatives and MNR, and relative changes in end of year averages for active IR alternatives compared to MNR	5
COPC Flux at RM 0, RM 8.3, and RM 15	Annual average fluxes during the 10-year post-remedy period	Averages compared among active IR alternatives and MNR, and relative changes in averages for active IR alternatives compared to MNR	6
	Cumulative fluxes during the 10-year post-remedy period	Cumulative fluxes compared among active IR alternatives and MNR, and relative changes in cumulative fluxes for active IR alternatives compared to MNR	7
	Annual average fluxes during IR implementation period	Averages compared among active IR alternatives and MNR, and relative changes in averages for active IR alternatives compared to MNR	8

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	Cumulative fluxes during IR implementation period	Cumulative fluxes compared among active IR alternatives and MNR, and relative changes in cumulative fluxes for active IR alternatives compared to MNR	9
COPC erosion flux for RM 8.3–RM 15 sediment	Annual average flux during the 10-year post-remedy period	Average fluxes compared among active IR alternatives and MNR, and relative changes in average for active IR alternatives compared to MNR	TBD
Average Water Column COPC Concentration on depositing fine sediment for RM 8.3–RM 15	Average concentration over the 10-year post-remedy period	Average concentrations compared among active IR alternatives and MNR, and relative changes in average for active IR alternatives compared to MNR	TBD

Notes:
COPC = chemical of potential concern
FS = feasibility study
IR = interim remedy
MNR = monitored natural recovery
SWAC = surface area-weighted average concentration
TBD = to be determined